On Modelling the Post-Glacial Rebound Geodetic Signature in Greenland and Antarctica

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Post-glacial rebound (PGR) drives a detectable time-dependent gravity and crustal motion signature in North America and Eurasia. The "remnant" mantle gravitational deformation driven by retreat from Last Glacial Maximum (≈ 22-21 to 8-7 kyr BP) in Laurentia and Fennoscandia have been unambiguously detected in both terrestrial and space-based geodetic data. The amplitude of the PGR signal can be linked to the size and spatial extent of those former ice sheets. Although a substantial PGR signal might be extracted from geodetic data in Greenland and Antarctica, since more extensive ice complexes also existed at Last Glacial Maximum two additional signals complicate both forward and inverse modelling. First, these ice sheets may have more youthful (0 - 6 kyr BP) mass exchange with the oceans. This past mass exchange can only be partly constrained in space and time. This exchange, while small in relative amplitude (only a few meters in equivalent sea level change), has the potential for driving a significant signal due to its relative youth. Secondly, the present-day ice mass and density change of these ice sheets may have an equally important contribution to both the gravity and crustal motion signatures. Ideally, simultaneous measurements of altimetric ice heights and space-based gravity could be used to isolate the present-day ice mass balance signatures (Wahr et al., 2000, in press). Here we address recent PGR model improvements that can be attempted, from both the perspective of ice history and mantle viscosity. Our current set of a priori Antarctic PGR models will be more tightly constrained by future GRACE gravity, GPS crustal motion and altimetric ice height data.